The Perceptron

Section 1, Lecture 4

The building block of a neural network is the **artificial neuron**. At the most basic level it has data inputs, a processing stage (the big gray circle) and an output.

This is an example of how the neuron process the inputs. The inputs are data points. (orange arrows)

1) All the inputs are scaled down. When a signal comes in (data point), it gets multiplied by a weight value. If a neuron has three inputs, like ours does, then it has three weights. During the learning phase, the network will adjust the weights based on errors of the last results.

2) During the next phase all the signals are summed up. That cool looking E is a summation object. the modified input signals are summed up to a single value. In this step, an offset is also added to the sum. This offset is called *bias*. The neural network also adjusts the bias during the learning phase.

This is where the learning takes plase.  At the start, all the neurons have random weights and random biases. After each learning iteration, weights and biases are gradually shifted so that the next result is a bit closer to the desired output. This way, the neural network gradually moves towards a state where the desired patterns are “learned”.

3) Finally, the result of the neuron’s calculation is turned into an output signal. This is done by feeding the result to an activation function (also called transfer function).

Note: This is a distinction to be made between the artifical Neuron and the perceptron however most literature will use the terms as synonyms. The response we taken from a Quora question on the topic.

"Here's the best way I've found to describe the difference:

Perceptrons come first in 1950s, and it uses a brittle activation function to do classification, so if w\*x is greater than some value it predicts positive, otherwise negative.

Neurons uses a softer activation function by introducing a sigmoid function, a tanh function or other activation functions to pass on values to other neurons in the network.

So perceptrons do not use in a network setting, they do classification on their own, hence they can’t classify XOR, however neurons can because they all contribute forward to the final output, using more complicated structure(i.e. multiple layers in network), they are able to classify XOR and other complicated problems."

-- Bexian Xiong, Data Science Graduate,Machine Learning and Data Mining Practicer